Traveling Science Shows

THE FRANKLIN INSTITUTE

Post-Show

HUMAN BODY

After the Show

We recently presented a Human Body show at your school, and thought you and your students might like to continue investigating this topic. The following activities are designed to review and extend the ideas covered in the show.

Please remember to use appropriate safety measures for all activities. An adult instructor should always supervise students during experiments.

Visit us online at www.fi.edu/TSS or contact us at tss@fi.edu.

DIVIDE AND DIGEST

FOR GRADES 1-4

Food contains the energy we need to live, move, and grow – but in order to access that energy, we have to digest the food. During the show, we examined the components of the digestive system. In this activity, students will simulate the process of digestion. Gloves and safety goggles are recommended for anyone handling alcohol.

EQUIPMENT

Baby carrots
Plastic knives
1 small beaker (or other glass container)
1 large beaker (large enough to hold the small beaker)
90% rubbing alcohol
Water
Hot plate
2-cm. wide strip of coffee filter

PROCEDURE

1. Cut baby carrots into small pieces. How does this begin the digestion process? What parts of the digestive system does this simulate?
2. Place carrot pieces into the small beaker. Add alcohol until the carrots are just covered.
3. Place the small beaker into the large beaker. Fill the large beaker with water so the water is about ½" below the lip of the small beaker.
4. Place the beakers on a hot plate and heat on high until the alcohol begins to boil. Reduce heat and simmer for 15 minutes. Avoid inhaling direct fumes. How does the alcohol help to digest the carrots? What parts of the digestive system does this simulate?
5. Remove from heat and observe the mixture. How have the carrots changed since the beginning of the experiment?
6. Dip the tip of the coffee filter strip into the mixture, touching the top of the carrots. What happens? What part of the digestive system absorbs nutrients from digested food?

WHY?

Cutting up the carrot simulates the mechanical digestion that takes place when we chew our food. Mechanical digestion continues in the esophagus, stomach and small intestine as food is squeezed and mashed. Food also goes through chemical digestion, in which strong acids in the saliva and the stomach break down the food into small molecules. In this activity, the alcohol simulates the effect of these chemicals. Once the food is broken down, nutrients can be absorbed through the walls of the small intestine by villi, just as the coffee filter absorbed the liquid from the carrot mixture. Without a combination of mechanical and chemical digestion, food could not be broken down enough for the nutrients to be absorbed efficiently.

HOW LARGE ARE YOUR LUNGS?

FOR GRADES 3-6

Our Traveling Scientist showed how the diaphragm changes air pressure in the chest cavity, causing our lungs to inflate or deflate. In this activity, students will calculate the capacity of their own lungs.

EQUIPMENT`

Tub or large dishpan
Empty 1-gallon jug
Water
Flexible rubber tubing
Measuring cup

PROCEDURE

1. Fill the tub about one-quarter full of water. Fill the jug completely full with water.
2. Put your hand tightly over the mouth of the jug and invert it into the tub. Make sure that no air gets into the jug.
3. Bend the rubber tubing and slip one end into the jug. Put the other end into your mouth. With one continuous breath, keep blowing until you are completely out of air.
4. When you cannot blow any more water out of the jug, slide your hand over the mouth of the jug and turn it right side up.
5. To measure how much air you exhaled, pour measuring cups of water into the jug until you have re-filled it. The amount of water you use to refill the jug is the amount of air you exhaled. Older students may choose to graph the results, or calculate the class's average capacity.

WHY?

As you blow through the tubing, air forces water out of the jug. After you have expelled as much air as possible from your lungs, you can measure the amount of water that was displaced from the jug. This is a measure of your "vital capacity." There is always some residual air left in your lungs, which can never be expelled. Lung capacity varies from person to person, and can be increased by aerobic training.

EVEN APPLES NEED SKIN

FOR GRADES 5-8

During our show, one lucky volunteer demonstrated how many functions our skin performs for us. In this activity, students will conduct a controlled experiment to determine the role of skin in protecting our bodies from harmful microorganisms. Before the experiment, an adult should sterilize the needles by briefly heating each in the flame of a candle or lighter.

EQUIPMENT

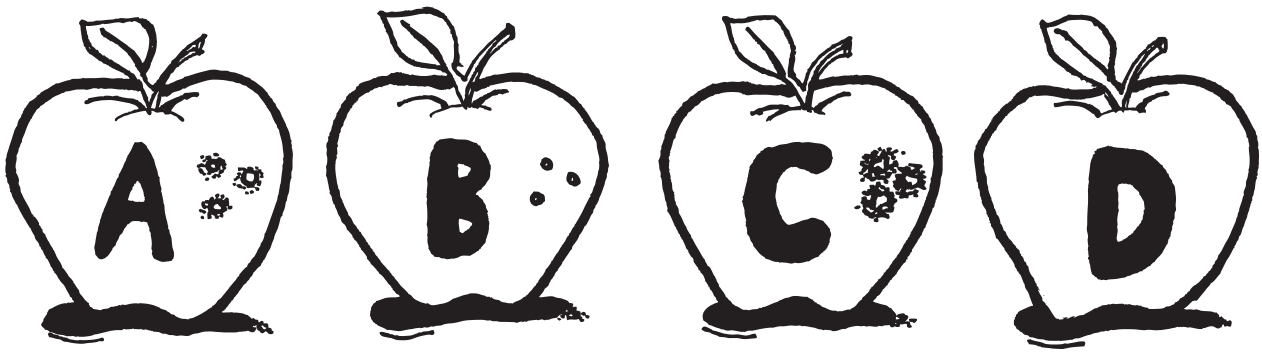
4 unblemished apples
Permanent marker
3 sterilized sewing needles
Small sample of rubbing alcohol
Small sample of soil

PROCEDURE

1. Use the marker to label your group's apples A, B, C, and D.
2. With a sterile needle, puncture apple A in three places.
3. With a different sterile needle, puncture apple B in three places. Apply rubbing alcohol over the punctures.
4. Roll the last sterilized needle in the soil, then use it to puncture apple C in three places.
5. Do nothing to apple D.
6. Predict what will happen to each apple over time
7. Observe the apples daily for a week. Record observations or drawings of the changes taking place. Why do the rotten spots grow each day?
8. Compare and contrast what happened to the apples. Which apple experienced the most dramatic changes?
9. Compare the skin of an apple to your skin. What might happen if your skin were punctured or wounded? What could you do to prevent an infection?

WHY?

Our skin prevents microorganisms from entering our body. When a cut or wound in the skin lets in microorganisms, we are prone to infection and disease. Cleaning a cut with antiseptics and covering the wound with a bandage helps protect us. In this experiment, students can observe what might happen if a wound is not properly treated. As microorganisms invade the apple, they multiply quickly and rot the apples. Discuss with students what makes this a controlled experiment. Note that apple D is the control. In the other apples, the independent variable, or the factor that is manipulated, is the level of contamination by microorganisms. The dependent, or responding, variable is what happens to the apples over time.



MORE INFORMATION...

We've provided the following information to help refresh your memory about the topics we covered during the show, and to deepen your understanding about the human body.

Organ System: A system is a collection of parts, each with a distinct function, that work together to accomplish a task. The human body is made up of several organ systems, each of which has a specific role. Within a system, each organ plays a part in the overall process. All of the systems work together so that we remain healthy, active, and growing.

Digestive System: The digestive system is essentially a tube, approximately 8-9 meters long, that begins at the mouth and ends at the anus. Over the course of 1-3 days, food travels along this tube and is continually broken down both mechanically and chemically. This process releases nutrients (including carbohydrates, proteins, and fats), which are absorbed by the bloodstream. The remaining useless matter is then expelled from the body.

Circulatory System: Blood is the body's transportation system. About 54% of blood is plasma, which is mostly water. Plasma brings nutrients to all the parts of the body and takes out the waste. Another 45% is made of red blood cells, which bring oxygen to all parts of the body. Only about 1% is white blood cells, which destroy foreign invaders in the bloodstream. Blood is pushed through veins, arteries, and capillaries by your body's pump: the heart.

Nervous System: The command center of the nervous system is the brain, which sends and receives messages through the nerves. Nerves contain specialized cells called neurons, which transmit information as electrochemical impulses from one area of the body to another. The main avenue of this system is the spinal cord, a thick bundle of nerves that runs down the center of the spine. Branching out from the spinal cord is a vast network of nerves, which allow the brain to communicate with every part of the body. Some nerves carry information to the brain, allowing us to hear, see, touch, smell and taste. Other nerves carry information from the brain to the muscles, controlling our body's movement.

Musculo-Skeletal System: This system, which includes over 600 muscles and 206 bones in adults, provides the structure for our body and allows us to move. Skeletal bones support and protect our organs. Bones also store calcium, regulate some hormones, and produce red blood cells. Muscles are made up of special tissues that can contract. There are three types of muscle cells: skeletal, cardiac, and smooth. Skeletal muscles are attached to our bones by flexible tissue called tendons. When skeletal muscles contract, they pull on the tendons, which pull on the bones and cause our limbs to move. Muscles can get shorter and pull, but they cannot push. They are arranged in opposing teams. One team pulls the body part one way, then the other team pulls it back again.

Immune System: This is the body's defense system. The skin and mucous membranes protect the body first, by creating a barrier to prevent bacteria and viruses from entering. If a bacteria or virus does enter the body, the immune system activates on a variety of levels. The most important element of this defense is the white blood cell, which will attack and kill foreign microorganisms and viruses.

Respiratory System: The role of the respiratory system is to take in oxygen (which is needed to power the metabolic functions of our cells) and expel carbon dioxide (which can be harmful if it builds up in our bodies). The inflation and deflation of our lungs is driven by the diaphragm, which changes the air pressure in the chest cavity. When we breathe in, air travels through the mouth, pharynx, larynx, trachea, and into the lungs. In the lungs, tiny branches called alveoli add oxygen to the blood and remove carbon dioxide. This oxygen is then delivered to cells throughout the body. Hence, the respiratory system is closely linked to the circulatory system.

MORE RESOURCES...

The Franklin Institute: On your next field trip, check out The Giant Heart to learn all about our circulatory system. Follow the path of blood through the heart, then learn how to keep your heart healthy. Go to http://www.fi.edu/teacherresources/ for a guide to the exhibit.

The Human Heart: Visit http://www.fi.edu/learn/heart/index.html to learn all about this amazing muscle! Find out about the structure of the heart, monitoring the heart, and even how to keep your heart healthy. You can even try some activities right in your own classroom.

The Human Brain: Check out http://www.fi.edu/learn/brain/index.html for in-depth information about how your brain works. You'll learn how to nourish and protect your brain, the control center of your entire body.